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Witch Flounder in NAFO Subdivision 3Ps

Plie grise de la sous-division 3Ps de l'OPANO

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Abstract

Landings from this stock over the last 20 years have fluctuated between 300t and 1000t. From 1986-1993 landings were relatively stable averaging around 1000t annually. During the past five years landings averaged just over 500 t but were as low as 250t in 1996. The main directed fishery is prosecuted by offshore otter trawlers complemented by a nearshore Danish seine fishery. However, in recent years it appears to be a mixed American plaice and witch flounder fishery by otter trawlers. During 2000-2003 American plaice catch rates in the otter trawl directed witch flounder fishery ranged from 72-143% of the witch catch, compared to less than 6% by Danish seiners. In 2004 by-catch of American plaice in the otter trawl component of this fishery declined to about 50%. Although survey stock size indices since 1983 have been highly variable, the survey biomass index during recent years suggests that the biomass is on average about 75% of the 1983-1990 average when catches were around 800t. The age and size structure observed in this stock since the early 1980s also appear to have remained stable with little change in growth pattern. Geographic distribution has not changed appreciably since 1983 except during the early to mid 1990s when fish disappeared from the 83-193m depth zone coincident with extremely cold sea bottom water temperatures. In recent years the distribution appears to be returning to a more normal pattern. No measurable change in recruitment has been observed over the past 20 years.

Résumé

Au cours des vingt dernières années, les débarquements annuels de plies grises appartenant à ce stock ont varié entre 300 et 1 000 t. De 1986 à 1993, ils étaient relativement stables et se chiffraient en moyenne à environ 1 000 t. Au cours des cinq dernières années, ils ont été en moyenne légèrement supérieurs à 500 t, mais ont atteint seulement 250 t en 1996. La principale pêche dirigée est effectuée par des chalutiers à panneaux hauturiers, et complétée par une flottille côtière de senneurs danois. Cependant, au cours des dernières années, il semble que les chalutiers à panneaux aient effectué une pêche mixte de la plie canadienne et de la plie grise. En effet, de 2000 à 2003, les taux de prises accidentelles de plie canadienne au cours de la pêche dirigée de la plie grise au chalut à panneaux ont varié entre 72 et 143 %, comparativement au taux de moins de 6 % pour la pêche par les senneurs danois. En 2004, le taux de prises accidentelles de plie canadienne des chalutiers à panneaux au cours de cette pêche a diminué d'environ 50 %. En dépit du fait que les indices de l'effectif du stock ont été très variables depuis 1983, les indices de biomasse des dernières années portent à croire que la biomasse se chiffre en moyenne à environ 75 % de la moyenne pour la période de 1983 à 1990, lorsque les prises atteignaient environ 800 t. Les structures d'âge et de taille pour ce stock semblent également stables depuis le début des années 1980, sans changement notable en ce qui concerne la croissance. La répartition géographique a peu varié depuis 1983, sauf au cours de la première moitié des années 1990 quand le poisson a disparu de la zone située entre 83 et 193 m de profondeur, lorsque les eaux de fond étaient extrêmement froides. Depuis quelques années, la répartition semble redevenir plus normale. Le recrutement n'a pas varié de manière notable au cours des vingt dernières années.

Commercial Fishery

Description of the fishery

The first total allowable catch (TAC) was established for this stock in 1974 at 3000 tons, which remained in effect until 1988 when it was reduced to 1000 tons (Fig. 1). It was further reduced to 500 tons in 1996 and 1997 but was increased again to 650 tons for 1998 and has remained at that level since then.

Catches of witch flounder in NAFO Subdivision 3Ps (Table 1; Fig. 1) ranged between about 300 and 1000 t annually since the early 1970's when the catch was reported to be over 4200 tons. From 1986-93, annual catches were relatively stable averaging around 1000 tons, however, since then the average annual catch has been just over 400 tons. During the 1980's the catch was primarily a by-catch of other groundfish fisheries, however, in recent years with the severe declines in other major groundfish resources, in particular, cod and American plaice, certain sectors of the fishing industry have come to depend more on catches delivered from this stock. The main participant is Canada (Newfoundland) with relatively small catches being taken by France (St. Pierre & Miquelon).

Catches have been taken primarily by Canadian (Newfoundland) trawlers (Table 2; Fig. 2) fishing offshore on St. Pierre Bank. Effort was usually concentrated along the deeper southwest slope of the bank in Statistical Area 3Psg and at the tail of the bank into Halibut Channel in Statistical Area 3Psh. However, during the past 10 years or so nearly all the offshore otter trawler effort for witch flounder occurs in Statistical Area 3Psh (Table 3).

The American plaice fishery in Subdivision 3Ps has been closed since 1994. Bycatches of American plaice in the witch flounder fishery often exceed 100% whereas seine catches have had very little American plaice bycatch (Table 4).

Length Compositions

Length frequency distributions from the Canada (Newfoundland) offshore otter trawl fishery from 1996-2005 are presented in Figure 4. Most of the annual witch flounder catches are comprised of fish in the range of 35-50 cm with modes mostly in the range of 40-42 cm. Although some small variation in the size composition was apparent for 1996-1997 virtually no variability was observed for other years.

Data available from the seine catches for 2000-2004 are shown in Figure 5. Most of the distributions from the seine fishery for witch flounder show sizes ranging from 30-42cm with modes around 33-38 cm. The 2000 data were more similar to the otter trawl data, with most fish in the 32-46cm size range.

Research Vessel Surveys

Survey Biomass and Abundance Indices

Standard stratified random bottom trawl surveys during winter-spring were conducted by Canada (N) in NAFO Subdivision 3Ps using an *Engel 145* High Rise otter trawl with bobbin footgear from 1983-1995. However, in late 1995 the standard survey gear was changed to a *Campelen 1800* shrimp trawl using rockhopper footgear. Therefore, all subsequent surveys were conducted using the new gear. Prior to the changeover, comparative fishing trials were carried out and length based conversion factors developed for the major species (witch flounder included) to allow for uninterrupted continuation of the survey time series. The details of the comparative fishing trials and development of the agreed conversion factors have been discussed in previous papers and won't be repeated here (see Bowering 1999 for witch flounder in Subdivision 3Ps). All data

presented here are based on *Engel 145* data converted to *Campelen 1800* equivalents for 1983-1995 and true *Campelen 1800* data for 1996-2004. A map showing the survey area and strata is provided in Figure 6.

The estimated abundance and biomass indices, as well as mean number and weight per tow by stratum and year, are presented in detail in Tables 5-8. Graphic illustrations of trends are shown in Figure 7 with 95% confidence limits on the research vessel survey data.

Abundance and biomass indices have been highly variable over the 20 year period examined with little in the way of discernible trends (Tables 5-8; Fig. 7). The error bars on the annual estimates are extremely large in many cases probably reflecting the patchiness of the distributions. Nevertheless, the biomass estimates during the 1990's are lower than those of the 1980's. The lowest biomass value observed occurred in 1999 but values have increased in recent years and are currently in the range of the 1980s values.

An examination of survey indices by depth zone would suggest that up until about 1988 considerable biomass was estimated for nearly all strata surveyed in 93-183 m (51-100 fathoms) (Table 6). However, during 1990-97 few strata at these depths had any witch flounder biomass observed in them and for those that that did it was negligible. More recently, witch flounder again appeared in higher abundance in this depth zone especially during the 1999-2000 and 2004 surveys but was lower again in 2001-2003. It is possible that the distribution shift to and from the area is related to bottom temperatures, which, for the surveys, are given in Table 9. When plotted against bottom temperature in the 93-183m depth zone (Fig. 8), the percentage of the biomass index in this zone decreases when temperatures decrease to values near or below zero. The highest proportions of the biomass seen in this zone occur when the temperatures are higher than 1 degree Celsius.

Length Compositions

Length (cm) frequency distributions as estimated abundance at length from the true *Campelen 1800* surveys of 1996-2005 are illustrated in Figure 9 with the <20 cm range magnified in Figure 10 to examine for potential recruitment. Witch flounder were present in all surveys from 1996-2005 up to a length of at least 50 cm with most of the abundance occurring in the range of about 20-40 cm (Fig. 9). These observations are similar to the length compositions from 1983-1995 presented in previous assessments (Bowering 1999; Bowering and Power 2002). The number of fish estimated in the smaller size range of <20 cm was highly variable and there are no distinct modes of potentially strong year-classes that could be tracked from year to year (Fig. 9). However, in some years (1998, 2000-2002 and 2005), there were higher numbers of witch flounder <10 cm estimated compared to other years since 1997 where very few were observed (Fig, 10).

Geographic Distribution

Annual Spring Groundfish Surveys 1994-2005

Distribution plots of witch flounder in Subdivision 3Ps are presented as Canadian survey catches (kg/set) for the survey years 1994-2005 (Figs. 11-12). Witch flounder are distributed rather continuously in the deeper water along the southwestern slope of St. Pierre Bank and throughout the Laurentian and Hermitage Channels. Few, if any, are caught on the shallow parts of St. Pierre Bank, Green Bank or Burgeo Bank. Recent surveys have been extended into Fortune Bay and Placentia Bay where some catches of witch flounder also have been encountered. The area of highest abundance in the offshore appears to be along the mid southwest slope of St. Pierre Bank although this is not necessarily consistent with the area of effort concentration by otter trawlers. On the other hand, the area of highest abundance in the more coastal region appears tc be in the inner part of Hermitage Channel just off Hermitage Bay where the Danish/Scottish Seiner effort has concentrated. Overall, the general distribution of witch flounder does not appear

to have changed during the period shown here and is now much similar to the earlier years (Bowering 1999).

Unit 2 Redfish Surveys

Redfish directed surveys using stratified random design were conducted in Unit 2 (NAFO Divisions 3P and 4V) using the *Campelen 1800* survey trawl during the summers of 1994-96, 2000 and 2002. Details and distribution plots are given in Bowering and Power (2002). Since catches were evenly distributed in the survey area especially throughout the Laurentian Channel, it is likely that the Div. 3P-4V boundary is arbitrary with respect to stock boundaries.

GEAC Fall Surveys 1998-2004

Annual GEAC fall surveys have been conducted from 1998-2004. Biomass and abundance indices are lower than those from the DFO research vessel surveys for all years except 1999, and do not follow the same general trends (Fig. 7).

Estimates of total mortality (Z) were calculated using the abundance at age from the GEAC survey for ages 6-13 (Fig. 13). Ages 6-8 show negative mortalities which are likely dure to those ages not being fully recruited to the survey. The older ages, particularly ages 12 and 13, show high total mortality.

Abundance at age from the GEAC surveys (Fig. 14) also show that witch flounder are fully recruited to the survey gear at around age 9 and then are rapidly lost from the survey.

Summary

The average annual catch during the 1996-2004 period is about 470 tons, approximately 60% of the 1983-90 average of 800 tons.

The mean biomass index for 1996-2005 is about 79% of the 1983-90 period.

The biomass index reached its lowest point in 1999 but has been increasing since then.

Length frequency distributions indicate little appreciable change in the size composition of the population at least over the past 20 years.

No indications of any measurable change in recruitment over the same 20 year period.

Although relatively low in abundance the population is widely distributed and continuous throughout subdivision 3Ps beyond the 50 fathom contour and into the deeper waters of neighbouring NAFO Divisions (3Pn; 4Vs; 4Vn).

References

Bowering, W.R. and D. J. Power. 2002. Observations on the witch flounder population in NAFO Subdivision 3Ps from the commercial fishery and research vessel survey data. DFO Can. Sci. Advis. Sec. Res. Doc. 2002/099, 34p.

Bowering, W.R. 1999. Stock status of witch flounder in NAFO Subdivision 3Ps. DFO Can. Sci. Advis. Sec. Res. Doc. 1999/144, 31p.

Table 1. Landings of witch flounder in subdivision 3Ps by country during 1974-2005.

	CAN-MQ	CAN-N	FRA-SP	E/PRT	USSR	E/FRA-M	CAN-M	Total Catch	TAC
1974	94	1605	47	40				1786	3000
1975	187	1183	41	13	4			1428	3000
1976	40	826	32	2	3			903	3000
1977	219	3973	55					4247	3000
1978	23	978	6					1007	3000
1979		756	8			17	73	854	3000
1980		790	20				31	841	3000
1981		412	53				4	469	3000
1982		419	56				14	489	3000
1983		256	125				6	387	3000
1984		327	34			2	115	478	3000
1985		396	118			2	81	597	3000
1986		613	606				110	1329	3000
1987		1131	71			53	18	1273	3000
1988		475	53			6	102	636	1000
1989		831	67				29	927	1000
1990		940	73				31	1044	1000
1991		1056	216				59	1331	1000
1992		1012	50				68	1130	1000
1993		956					17	973	1000
1994		429					2	431	1000
1995		273					1	274	1000
1996		250					6	256	500
1997		259	7				30	296	500
1998		452	43				4	499	650
1999		509	33				18	560	650
2000		332	7				7	346	650
2001		450	85				33	568	650
2002		517	38				1	556	650
2003		529	4				8	541	650
2004		543	37				7	587	650
2005		406					3	409	650

Table 2. Landings of witch flounder in subdivision 3Ps by gear type during 1974-2005 for Canada (N) only.

Year	OTB	SEINES	OTHER	TOTAL	TAC
1974	1409	177	19	1605	3000
1975	684	491	4	1179	3000
1976	590	153	58	801	3000
1977	3387	454		3841	3000
1978	627	342		969	3000
1979	484	75	2	561	3000
1980	569	219	2	790	3000
1981	168	233	11	412	3000
1982	284	50		334	3000
1983	147	1	6	154	3000
1984	322		3	325	3000
1985	198	175	3	376	3000
1986	285	297	31	613	3000
1987	879	217	35	1131	3000
1988	260	153	62	475	1000
1989	557	196	78	831	1000
1990	635	244	61	940	1000
1991	789	195	72	1056	1000
1992	761	214	37	1012	1000
1993	712	183	61	956	1000
1994	131	288	10	429	1000
1995	4	268		273	1000
1996	77	172	1	250	500
1997	135	122	2	259	500
1998	261	189	3	454	650
1999	233	235	41	510	650
2000	154	166	11	331	650
2001	281	141	27	449	650
2002	360	131	27	518	650
2003	362	141	27	530	650
2004	364	141	37	542	650
*2005	321	58	27	406	650

*Data for 2005 are preliminary to Sept 2, 2005.

Table 3. Landings of witch flounder (Canada (N)) in Subdivision 3Ps by statistical area from 1985-2005.

	Statistical Area							
	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh
1985	15	113		36	12	26	94	120
1986	16	227	2	68	5	14	136	163
1987	49	151	1	52	7	44	236	539
1988	4	70	2	37	1	8	58	238
1989	11	167	2	8		12	73	476
1990	5	179	2	25	11	3	286	322
1991	4	71	3	10		6	115	590
1992	16	62		7		5	281	464
1993	4	259		7			88	593
1994	7	317	3	1			1	109
1995	16	213	40	2			1	2
1996	89	80		3				82
1997	20	51					16	148
1998	122	64	7	2			1	258
1999	72	141	9	1	22		1	264
2000	10	154	1	21				144
2001	9	156	2	3			1	277
2002	29	122	16	11			3	338
2003	43	125	2	13			5	343
2004	46	145	2	26			6	318
2005	62	21	2	0	1			319

Notes:1) There are years when some of the catch has not been reported by unit area.
2) Data for 1998 to 2002 are updated from those reported in SCR 02/99

Table 4. Bycatch of American plaice in the Otter trawl and Danish seine fisheries for witch flounder in NAFO subdivision 3Ps.

	Otter trawl fleet			Danish seine fleet	
	Tons of plaice	% bycatch		Tons of plaice	% bycatch
1999	118	46	1999	6	3
2000	200	143	2000	3	2
2001	235	101	2001	8	6
2002	296	92	2002	8	6
2003	229	72	2003	6	4
2004	146	49	2004	6	5

Table 5. Estimated Abundance (000s) of Witch Flounder (M+F) in each stratum from surveys in NAFO subdivision 3Ps from 1983-2004. (Engel 145 data converted to Campelen Units for 1983-94).

Sum of Abundance		YR																							
Range	Str	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 WT133	1993 WT135	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<=56	314	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	19	0	17	0	0	0
	320	532	0	0	0	0	0	0	0	0	0	0	318	0	30	0	0	0	0	0	0	0	0	149	0
57-92	293 [3]																0	0	0	0	0	0	0	0	0
	308	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
	312	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0
	315	284	796	0	265	0	341	179	0	0	0	0	0	0	0	0	0	16	72	116	0	0	0	173	100
	321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	0	0	0	98	0	0	16	0	0
	325	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0
	326	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0
	783 [1]													0			0	0	0	0	0	0	0	0	0
93-183	294 [3]																0	0	0	0	0	9	65	0	0
	297 [3]																63	0	660	385	0	21	0	38	167
	307	408	109	290	18	0	0	0	0	0	0	0	54	353	0	41	0	0	223	72	0	0	127	72	39
	311	0	414	55	5945	15	240	58	0	44	0	15	0	33	87	0	0	15	1508	1875	0	15	0	44	1242
	317	9770	16487	252	544	9	690	0	0	0	119	0	53	0	0	0	0	478	2217	6252	13	0	0	3864	199
	319	445	338	68	761	587	457	4010		60	0	0	0	0	406	1339	15	1946	846	2320	2927	1083	118	4126	4822
	322	39	620	0	162	0	36	0	0	0	0	0	0	0	33	150	118	29	32	2254	1257	66	116	166	497
	323	1548	48	319	19	383	38	41	0	0	0	0	0	0	0	22	24	207	46	432	32	16	0	16	0
	324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	0	0	0
	781 [1]													0	0	0	0	0	0	14	0	0	0	0	0
	782 [1]													0	0		0	0	13	0	0	0	0	0	0
184-274	295 [3]																661	1073	14	1849	142	43	1508	86	1107
	298 [3]																354	502	955	223	729	1610	623	153	3481
	300 [3]																371	2421	1030	410	338	254	876	1842	2284
	306	620	58	317	1114	144	43	134	0	922	115	58	29	86	100	1492	766	188	610	1291	350	1572	525	510	1015
	309	556	183	828	305	122	231	163	244	529	305	27	163	801	556	790	457	706	41	1112	81	163	640	814	977
	310	70	105	304	257	316	70	374	117	35	94	58	35	296	164	129	66	373	316	237	186	175	164	234	177
	313	1687	193	340	375	125	863	883	4142	340	1997	329	1975	5062	3007	898	295	1291	363	1634	1343	4188	4222	1812	1192
	316	6357	3874	4368	3952	4766	14975	5807	14403	143	14975		9940	1430	1729	8071	11128	4901	2590	2093	7683	6851	10439	10758	1638
	318	1128	178		3443	178	1870	76		4681	102	288	4941	0	6548	719	311	825	201	887	2023	1659	1180	754	914
	779 [1]													0	0	0	0	19	82	58	0	58	0	19	203
	780 [1]													0	0		0	0	156	25	18	166	37	0	148
275-366	296 [3]																352	191	102	469	230	932	24	541	348
	299 [3]																1492	2341	1721	3292	2189	3281	5149	3339	1516
	705	957	429	912	1113	590	2106	1194	456	2133	1623	550	724	581	711	891	1019	1085	440	858	1621	3353	1122	1119	994
	706	5098	3372	2488	4273	5147	3536	2063	5959	8299	6626	2728	5029	4240	7350	3318	2447	4551	1855	2588	3650	10968	6519	6963	3769
	707	443	198		403	512	192	294		6141	2309	678	409	0	2698	75	59	148	23	229	289	87	453	84	84
	715	751	163		209	309	327	890	36	0	163	45	413	295	660	471	72	76	44	446	337	2283	456	501	558
	716	1112	939	1691	4041	2373	2491	2892	3589	1987	2694	2002	1260	1394	756	5068	1598	2815	968	6790	2570	1823	5052	1483	2923
367-549	708	531	370		628	370	121	853		3275	467	660	225	1421	225	503	14294	193	29	160	104	83	69	447	135
	711	10724	7852	11088	15114	6459	5780	9575	8593	9452	17582	3013	5526	3083	7260	5363	2471	3446	3945	3707	2625	9609	7735	4410	3839
	712	6138		14857	10529	7161	6922	7077	7656	13652	18498	4264	3251	3557	14911	8195	4384	5499	3087	3455	6184	11329	7352	8400	7642
	713	3715		5472	6848	8200	8252	5668	7150	13068	12742	8870	3485	4313	6087	7036	6621	7682	4433	7336	7631	11336	9419	9185	11889
	714	2252			9140	5055	10356	8532	8712	12254	8924	4588	4932	2301	7461	7040	7394	6395	3892	4485	6446	9300	7548	8520	7053
550-731	709 [2]	20	7					647		1631		508	92	283	5955	718		1345	1336	1375	667	904	162	216	705
732-914	710 [1]	87	42	82	163		10			74		87	30	436					441						
Grand Total		56181	36877	43730	69623	42819	59957	51189	61058	78703	89336	29668	42903	29943	66736	50401	56831	50780	34295	58647	51667	83321	71736	58238	61657

[1] These strata were added to the stratification scheme in 1994

[2] Strata 709 was redrawn in 1994 and includes the area covered by strata 710 in previous surveys. All sets done in 710 prior to 1994 have been recoded to 709

[3] These strata were added to the stratification shceme in 1997.

Table 6. Estimated Biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in NAFO subdivision 3Ps from 1983-2004. (Engel 145 data converted to Campelen Units for 1983-94).

Sum of Biomass		YR																							
Range	Str	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 WT133	1993 WT135	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<=56	314	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0
	320	200	0	0	0	0	0	0	0	0	0	0	64	0	19	0	0	0	0	0	0	0	0	18	0
57-92	293 [2]																0	0	0	0	0	0	0	0	0
	308	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
	312	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	35	40	0	0	0	36	24
	315	134	273	0	68	0	76	44	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	325	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	326 [1]	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	783 [1]													0			0	0	0	0	0	0	0	0	0
93-183	294 [3]																0	0	9	0	0	0	6	0	0
	297 [3]																2	0	122	93	0	8	0	5	37
	307	51	49	39	13	0	0	0	0	0	0	0	10	64	0	1	0	0	81	33	0	0	6	23	9
	311	0	139	27	1584	6	79	7	0	7	0	5	0	9	15	0	0	2	416	377	0	1	0	1	287
	317	3253	4662	75	144	4	154	0	0	0	42	0	22	0	0	0	0	78	439	1301	0	0	0	605	63
	319	171	230	90	319	242	170	1716		21	0	0	0	0	90	618	8	829	265	548	884	468	2	1431	1813
	322	31	121	0	24	0	10	0	0	0	0	0	0	0	8	1	1	0	0	9	8	1	1	1	11
	323	791	30	285	14	169	36	35	0	0	0	0	0	0	0	10	0	1	24	2	0	0	0	0	0
	324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	781 [1]													0	0	0	0	0	0	0	0	0	0	0	0
	782 [1]													0	0		0	0	0	0	0	0	0	0	0
184-274	295 [3]																109	203	0	40	7	3	99	1	181
	298 [3]																90	188	386	90	159	359	97	11	646
	300 [3]																44	269	79	111	53	34	46	188	295
	306	209	16	101	177	61	23	74	0	57	14	16	7	30	24	72	42	35	91	101	18	86	18	48	66
	309	126	79	239	90	12	29	36	46	57	29	15	50	104	67	31	53	52	22	82	13	9	19	110	101
	310	34	66	128	139	51	33	117	77	9	7	29	5	63	22	11	11	40	90	31	34	42	31	23	31
	313	335	62	103	100	32	198	249	747	58	285	59	471	1244	623	158	47	248	78	412	246	602	880	280	270
	316	1598	1139	1275	1198	1260	3595	1343	2829	28	3124		2175	333	209	1512	1802	857	619	359	1464	1061	1654	1978	298
	318	286	35		1196	97	561	30		1538	17	61	1482	0	1540	149	119	212	48	108	482	377	287	175	248
	779 [1]													0	0	0	0	0	1	0	0	1	0	0	5
	780 [1]													0	0		0	0	1	0	0	2	0	0	1
275-366	296 [2]																181	23	35	40	47	119	3	146	59
	299 [3]																371	674	430	755	593	760	1121	629	265
	705	209	124	243	267	211	596	328	137	487	331	89	175	139	161	142	198	218	71	141	234	853	194	199	147
	706	1218	817	621	1067	1461	935	451	1205	2032	1482	764	1387	875	1442	571	451	873	318	507	570	2009	1285	1117	711
	707	117	44		192	180	62	116		2007	675	234	290	0	666	12	15	36	9	43	77	20	125	19	21
	715	173	48		84	112	93	248	28	0	43	14	106	68	139	90	20	12	23	88	75	399	111	95	100
	716	401	355	597	1321	936	920	918	1042	519	706	528	366	304	208	1045	275	480	242	1128	400	326	580	174	412
367-549	708	97	80		186	148	55	251		1741	167	239	62	342	64	92	4986	29	3	20	21	23	13	106	33
	711	1540	1218	1517	2385	1239	1058	1572	1470	1416	3378	846	1119	492	1078	667	326	464	471	418	350	1131	903	606	560
	712	940		2006	1556	1047	1228	944	1265	1945	3003	891	515	662	2011	860	446	636	321	335	626	928	722	726	742
	713	566		786	1073	1769	1240	919	1066	2149	2113	1526	554	690	903	718	846	625	451	535	600	1045	898	917	1013
	714	371			2152	937	2010	1344	1580	2309	1871	816	757	374	1136	747	1130	702	412	476	798	1136	862	695	517
550-731	709 [2]	3	2					137		379		114	38	42	890	59		126	137	79	80	168	19	41	61
732-914	710 [2]	15	11	13	28		4			17		21	1	57					39						
Grand Total		12864	9639	8147	15315	9929	13155	10907	11492	16757	17280	6285	9557	5878	11337	7564	11556	7891	5626	8283	7841	11775	9973	10402	9028

[1] These strata were added to the stratification scheme in 1994.

[2] Strata 709 was redrawn in 1994 and includes the area covered by strata 710 in previous surveys. All sets done in 710 prior to 1994 have been recoded to 709.

[3] These strata were added to the stratification shceme in 1997.

Table 7. Mean Numbers per tow of witch flounder (M+F) in each stratum from surveys in NAFO subdivision 3Ps from 1983-2004. Engel 145 data converted to Campelen Units for 1983-94.

Average of Mean_no		YR																							
Range	Str	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 WT133	1993 WT135	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<=56	318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.13	0.00	0.00	0.00
	320	2.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.00
57-92	293 [3]																0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	308	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
	312	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00
	315	2.50	7.00	0.00	2.33	0.00	3.00	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.64	1.02	0.00	0.00	0.00	1.52	0.88
	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.60	0.00	0.00	0.10	0.00	0.00
	325	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
	326	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	783 [1]													0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93-183	294 [1]																0.00	0.00	0.00	0.00	0.00	0.50	3.50	0.00	0.00
	297 [1]																3.00	0.00	31.56	18.43	0.00	1.00	0.00	1.83	8.00
	307	7.50	2.00	5.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	6.50	0.00	0.75	0.00	0.00	4.10	1.33	0.00	0.00	2.33	1.33	0.71
	311	0.00	9.50	1.25	136.33	0.33	5.50	1.33	0.00	1.00	0.00	0.33	0.00	0.75	2.00	0.00	0.00	0.33	34.59	43.00	0.00	0.33	0.00	1.00	28.48
	317	368.33	621.00	9.50	20.50	0.33	26.00	0.00	0.00	0.00	4.50	0.00	2.00	0.00	0.00	0.00	0.00	18.00	83.50	235.50	0.50	0.00	0.00	138.00	7.50
	319	3.29	2.50	0.50	5.63	4.33	3.38	29.63		0.44	0.00	0.00	0.00	0.00	3.00	9.80	0.11	14.38	6.25	17.14	21.03	8.00	0.88	30.48	35.63
	322	0.18	2.88	0.00	0.75	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.70	0.55	0.14	0.15	10.48	5.83	0.31	0.54	0.77	2.31
	323	16.17	0.50	3.33	0.20	4.00	0.40	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.25	2.17	0.48	4.51	0.33	0.17	0.00	0.17	0.00
	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
	781 [1]													0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00
	782 [1]													0.00	0.00		0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
184-274	295 [1]																23.00	37.33	0.50	64.30	4.94	1.50	52.44	3.00	38.50
	298 [1]																15.06	21.33	40.61	9.90	31.00	68.44	28.50	6.50	148.00
	300 [1]																12.44	81.11	34.50	13.72	11.33	8.50	29.33	58.06	76.50
	306	10.75	1.00	5.50	19.33	2.50	0.75	2.33	0.00	16.00	2.00	1.00	0.50	1.50	2.00	29.88	15.33	3.77	12.22	25.85	7.00	31.48	10.52	10.22	20.33
	309	13.67	4.50	20.33	7.50	3.00	5.67	4.00	6.00	13.00	7.50	0.67	4.00	19.67	13.67	19.41	11.22	17.33	1.00	27.30	2.00	4.00	15.72	20.00	24.00
	310	3.00	4.50	13.00	11.00	13.50	3.00	18.00	5.00	1.50	4.00	2.50	1.50	12.67	7.00	5.50	2.83	15.94	13.50	10.14	7.94	7.50	7.00	10.00	7.56
	313	74.33	8.50	15.00	16.50	5.50	38.00	38.00	182.50	15.00	88.00	14.50	87.00	223.00	132.50	39.56	13.00	56.89	16.00	72.00	59.17	184.50	186.00	71.00	52.50
	316	244.50	149.00	168.00	152.00	183.33	576.00	215.67	554.00	5.50	576.00		382.33	55.00	86.50	233.50	428.00	188.50	99.80	80.50	295.50	263.50	401.50	413.78	63.00
	318	66.67	10.50		203.50	10.50	110.50	4.50		275.50	6.00	17.00	292.00	0.00	389.00	40.50	17.50	46.50	11.32	38.72	114.00	93.50	66.50	42.50	51.50
	779 [1]													0.00	0.00	0.00	0.00	0.33	1.42	1.00	0.00	1.00	0.00	0.33	3.50
	780 [1]													0.00	0.00		0.00	0.00	2.82	0.44	0.33	3.00	0.67	0.00	2.67
275-366	296 [1]																36.06	19.56	10.44	48.00	23.50	95.39	2.50	55.36	35.64
	299 [1]																51.17	80.27	59.00	112.89	75.06	112.50	176.56	114.50	52.00
	705	35.67	16.00	34.00	41.50	22.00	78.50	44.50	17.00	79.50	60.50	20.50	27.00	21.67	26.50	33.20	38.00	40.44	18.38	32.00	60.44	125.00	41.83	41.72	37.06
	708	91.60	51.50	38.00	85.25	78.80	54.00	31.50	91.00	126.75	101.20	41.67	76.80	64.75	112.25	50.67	37.37	89.50	28.33	39.53	55.75	187.50	98.56	106.33	57.56
	707	34.67	15.50		31.50	40.00	15.00	23.00		480.00	180.50	53.00	32.00	0.00	265.00	7.40	5.78	14.50	2.22	22.50	28.43	8.50	44.50	8.28	8.29
	715	41.33	9.00		11.50	17.00	18.00	49.00	2.00	0.00	9.00	2.50	22.75	16.25	37.50	26.72	4.06	4.33	2.50	25.33	19.11	129.64	26.00	28.44	31.67
	716	15.00	12.67	22.80	54.50	32.00	33.60	39.00	48.40	26.80	36.33	27.00	17.00	18.80	10.20	68.35	21.56	37.97	13.06	91.58	34.67	24.58	68.14	20.00	39.42
367-549	708	33.00	23.00		39.00	23.00	7.50	53.00		203.50	29.00	41.00	14.00	82.00	13.00	29.00	824.67	11.11	1.69	9.22	6.00	4.80	4.00	25.78	7.78
	711	81.13	59.40	83.88	114.33	48.86	43.57	72.43	65.00	71.50	133.00	29.60	41.80	23.17	89.00	65.75	30.29	42.24	48.38	45.44	32.18	117.80	94.82	54.06	47.07
	712	45.86		111.00	78.67	53.50	51.71	52.88	57.20	102.00	138.20	31.88	24.29	26.57	148.29	81.50	43.60	54.89	30.50	34.38	61.50	112.67	73.11	63.65	78.00
	713	28.43		41.88	52.40	62.75	63.14	43.38	54.71	100.00	97.50	67.88	26.67	33.00	52.00	60.11	58.56	66.62	37.87	62.67	65.19	96.84	80.48	78.48	101.56
	714	13.70			55.60	30.75	63.00	51.90	53.00	74.55	54.29	27.91	30.00	14.00	50.50	47.65	50.05	43.28	26.35	30.36	43.63	92.95	51.09	57.67	47.74
550-731	709 [2]	1.50	0.50					49.00		123.50		38.50	7.00	13.00	294.50	35.50		66.50	66.06	68.00	33.00	44.70	8.00	10.67	34.86
732-914	710 [2]	17.67	8.50	16.50	33.00		2.00			15.00		17.50	6.00	18.00					20.57						
	Total	23.24	18.54	20.31	28.96	17.84	24.94	21.22	27.52	32.55	37.23	12.51	17.69	11.19	29.84	20.86	21.12	18.73	12.55	21.64	19.06	30.74	26.46	25.17	22.75

[1] These strata were added to the stratification scheme in 1994.

[2] Strata 709 was redrawn in 1994 and includes the area covered by strata 710 in previous surveys. All sets done in 710 prior to 1994 have been recoded to 709.

[3] These strata were added to the stratification scheme in 1997.

Table 8. Mean weight (kg) per tow of witch flounder (M+F) in each stratum from surveys in NAFO subdivision 3Ps from 1983-2004. Engel 145 data converted to Campelen Units for 1983-94.

Average of Mean_wt		YR																							
Range	Str	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 WT133	1993 WT135	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<=56	314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	320	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00
57-92	293 [3]																0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	308	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	312	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
	315	1.19	2.40	0.00	0.60	0.00	0.67	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.31	0.35	0.00	0.00	0.00	0.31	0.21
	321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	325	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	328	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	763 [1]													0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93-183	294 [3]																0.00	0.00	0.00	0.00	0.00	0.01	0.33	0.00	0.00
	297 [3]																0.08	0.00	5.82	4.44	0.00	0.38	0.00	0.23	1.75
	307	0.04	0.01	0.72	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	1.18	0.00	0.03	0.00	0.00	1.50	0.60	0.00	0.00	0.11	0.42	0.17
	311	0.00	3.18	0.02	35.87	0.13	1.80	0.16	0.00	0.15	0.00	0.11	0.00	0.20	0.35	0.00	0.00	0.04	9.53	8.64	0.00	0.02	0.00	0.02	6.59
	317	122.51	175.99	2.83	5.41	0.13	5.81	0.00	0.00	0.00	1.57	0.00	0.84	0.00	0.00	0.00	0.00	2.85	16.20	49.00	0.01	0.00	0.00	22.78	2.38
	319	1.26	1.70	0.69	2.36	1.79	1.26	12.68		0.18	0.00	0.00	0.00	0.00	0.69	4.56	0.06	6.13	1.96	4.05	6.53	3.46	0.01	10.57	13.40
	322	0.14	0.98	0.00	0.11	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.04	0.04	0.00	0.01	0.00	0.05
	323	6.27	0.32	2.98	0.15	1.72	0.31	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.01	0.26	0.02	0.00	0.00	0.00	0.00	0.00
	324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
	781 [1]													0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	782 [1]													0.00	0.00		0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
184-274	295 [3]																3.80	7.07	0.02	1.40	0.24	0.12	3.44	0.03	6.30
	298 [3]																3.83	8.00	12.98	3.82	6.75	15.28	4.11	0.45	27.45
	300 [3]																1.47	8.96	2.85	3.71	1.78	1.15	1.54	6.28	9.88
	306	3.61	0.28	1.75	3.07	1.06	0.40	1.28	0.00	0.99	0.25	0.28	0.12	0.52	0.47	1.44	0.85	0.70	1.03	2.02	0.38	1.73	0.38	0.95	1.33
	309	3.09	1.98	5.84	2.20	0.29	0.70	0.80	1.12	1.40	0.48	0.37	1.23	2.54	2.14	0.78	1.31	1.29	0.55	2.02	0.32	0.23	0.47	2.69	2.49
	310	1.48	2.78	5.40	5.90	2.17	1.41	4.99	3.30	0.40	0.29	1.22	0.23	2.71	0.96	0.48	0.45	1.71	3.84	1.34	1.44	1.79	1.33	0.99	1.33
	313	14.75	2.75	4.52	4.39	1.40	8.71	10.99	32.90	2.56	12.57	2.58	20.74	54.80	27.47	6.96	2.05	10.93	3.43	18.15	10.84	26.53	38.75	12.33	11.91
	316	61.45	43.83	49.03	48.08	48.45	138.28	51.64	106.83	1.06	120.17		83.64	12.81	8.04	58.16	69.30	32.98	23.81	13.83	56.33	40.83	63.60	76.09	11.45
	318	16.89	2.05		78.71	3.38	32.54	1.78		90.89	1.00	4.80	86.41	0.00	86.81	8.38	6.68	11.93	2.73	6.09	27.18	21.25	15.05	9.88	14.00
	779 [1]													0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.09
	780 [1]													0.00	0.00		0.00	0.00	0.01	0.00	0.00	0.04	0.01	0.00	0.02
275-366	296 [3]																16.43	2.36	3.55	4.10	4.83	12.23	0.33	14.93	6.02
	299 [3]																12.74	23.10	14.75	25.89	20.33	26.08	38.43	21.58	9.08
	705	7.78	4.64	9.67	9.97	7.87	22.23	12.13	5.10	17.42	12.34	3.31	6.52	4.76	6.01	5.28	5.90	8.01	2.65	5.24	8.71	24.33	7.23	7.41	5.47
	706	18.96	12.48	9.49	16.29	22.31	14.28	7.35	18.40	31.03	22.63	11.67	21.18	13.36	22.02	8.72	7.49	13.34	4.82	7.74	8.71	30.68	19.62	17.06	10.86
	707	9.15	3.48		11.86	14.06	4.87	9.10		156.85	52.79	18.29	15.60	0.00	65.43	1.14	1.43	3.50	0.76	4.25	7.55	2.00	12.28	1.88	2.08
	715	9.54	2.67		4.60	6.15	5.11	13.68	1.52	0.00	2.36	0.75	5.81	3.74	7.87	5.08	1.16	0.68	1.33	3.89	4.27	22.66	0.33	5.42	5.69
	716	5.41	4.78	8.05	17.82	12.65	12.40	12.39	14.06	7.00	9.55	7.12	4.93	4.10	2.80	14.10	3.71	6.20	3.26	15.22	5.40	4.40	7.83	2.35	5.55
367-549	708	6.05	4.97		11.54	9.20	3.41	15.60		108.19	10.38	14.85	3.84	19.72	3.68	5.30	287.78	1.65	0.18	1.14	1.20	1.33	0.73	6.11	1.91
	711	11.65	9.21	11.47	18.04	9.37	8.00	11.89	11.12	10.72	25.56	6.40	8.48	3.72	13.22	8.18	4.02	5.89	5.78	5.12	4.29	13.87	11.07	7.43	6.87
	712	7.03		14.99	11.63	7.82	9.17	7.05	9.45	14.54	22.44	6.65	3.85	4.95	20.00	8.55	4.44	6.33	3.19	3.34	6.23	9.23	7.18	7.22	7.38
	713	4.30		6.01	8.21	13.54	9.49	7.03	8.16	16.45	16.17	11.68	4.24	5.28	7.71	6.13	7.23	5.34	3.85	4.57	5.13	8.93	7.67	7.83	8.65
	714	2.26			13.09	5.70	12.22	8.17	9.61	14.05	11.38	4.96	4.61	2.27	7.69	5.05	7.65	4.75	2.79	3.22	5.40	7.69	5.84	4.71	3.50
550-731	709 [2]	0.23	0.17					10.35		28.71		8.61	2.86	1.91	44.00	2.93		6.25	6.78	3.93	3.98	8.31	0.93	2.05	3.03
732-914	710 [2]	3.12	2.28	2.55	5.75		0.76			3.51		4.34	0.24	2.37					1.83						
	Total	5.32	4.85	3.78	6.37	4.14	5.47	4.52	5.18	6.93	7.20	2.65	3.94	2.20	4.95	3.13	4.30	2.91	2.06	3.06	2.89	4.34	3.68	3.84	3.33

[1] These strata were added to the stratification scheme in 1994

[2] Strata 709 was redrawn in 1994 and includes the area covered by strata 710 in previous surveys. All sets done in 710 prior to 1994 have been recoded to 709.

[3] These strata were added to the stratification shceme in 1997

Table 9. Temperatures from research surveys 1983-2005 by depth zones.

	DepthZone							
YR	<=56	57-92	93-183	184-274	275-366	367-549	550-731	Average
83	2.37	0.59	0.53	5.09	5.24	4.83	4.70	3.20
84	1.75	0.92	2.05	6.41	6.08	5.36	5.40	3.55
85	-1.15	-1.14	0.27	6.09	7.23	5.75		3.46
86	-0.77	-0.92	0.70	7.35	6.64	5.63	5.70	3.37
87	-0.92	-0.73	0.11	5.79	5.54	4.98	4.20	2.55
88	0.16	0.33	0.83	5.95	5.66	4.70		3.16
89	-0.52	-0.32	0.23	4.15	5.28	5.11	4.50	2.72
90	-0.86	-0.83	-0.29	3.96	5.73	4.80		2.60
91	-0.27	-0.48	-0.01	4.13	5.48	4.91	4.35	2.73
92	-0.86	-0.69	0.16	5.35	5.41	4.76		2.87
93W	-0.72	-0.75	-0.04	6.24	6.17	5.20	4.65	3.25
93s	-0.39	-1.00	-0.66	6.44	6.71	5.22	4.67	3.32
94	0.41	-0.70	-0.34	4.66	5.91	5.06	4.30	2.80
95	0.33	-0.56	0.09	5.30	6.02	5.11	4.48	3.63
96	1.07	0.34	1.33	5.28	5.83	5.15	4.28	3.96
97	0.20	-0.41	0.05	5.26	5.18	4.79	4.10	3.51
98	1.72	0.39	0.80	4.11	4.73	4.72	4.15	2.83
99	2.49	0.70	1.34	4.20	5.12	4.91	4.70	3.14
00	2.51	0.93	1.78	4.95	5.91	5.16	4.38	4.03
01	0.67	-0.07	0.00	4.04	5.02	4.87	4.25	2.58
02	0.92	-0.08	0.19	4.97	5.38	5.19	4.50	3.65
03	-0.32	-0.76	-0.52	3.54	5.45	4.87	4.27	2.37
04	1.38	0.57	0.65	4.41	4.77	4.78	4.25	2.88
05	1.91	0.79	1.65	4.20	5.12	4.86	4.36	3.20
Total	0.57	-0.09	0.52	4.96	5.60	5.02	4.44	3.19

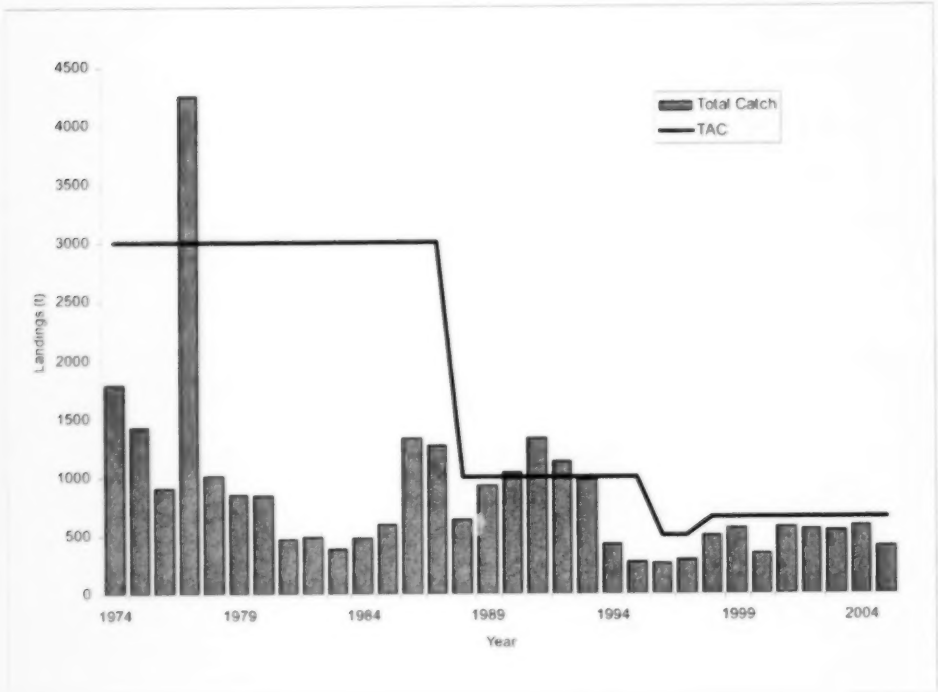

Fig. 1. Total landings and TACs of witch flounder from Subdivision 3Ps during 1974-2005 (2005 data are preliminary to Sept 2).

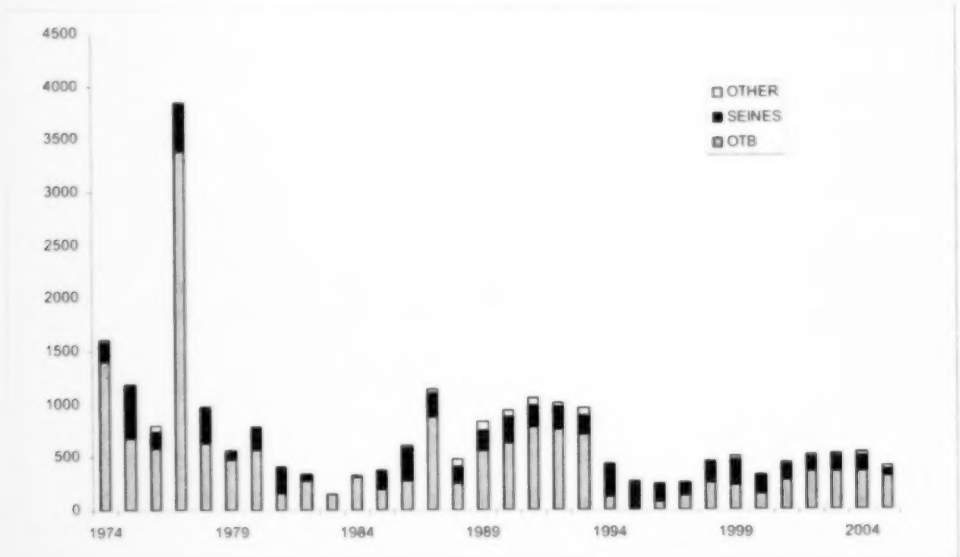

Fig 2. Landings by gear type of witch flounder by Canada (N) from Subdivision 3Ps during 1974-2005 (2005 data are preliminary to Sept 2).

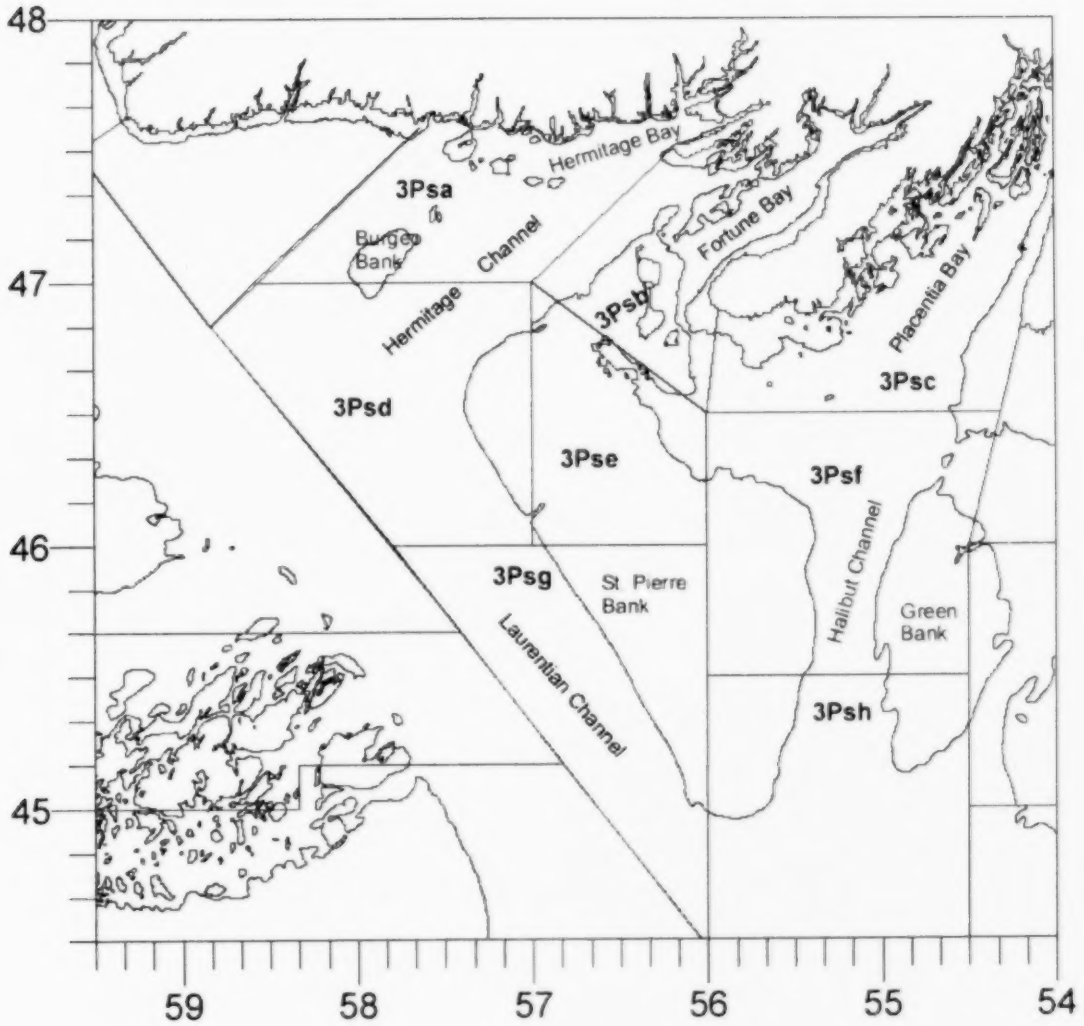

Fig. 3. Commercial catch reporting statistical area for NAFO Subdivision 3Ps.

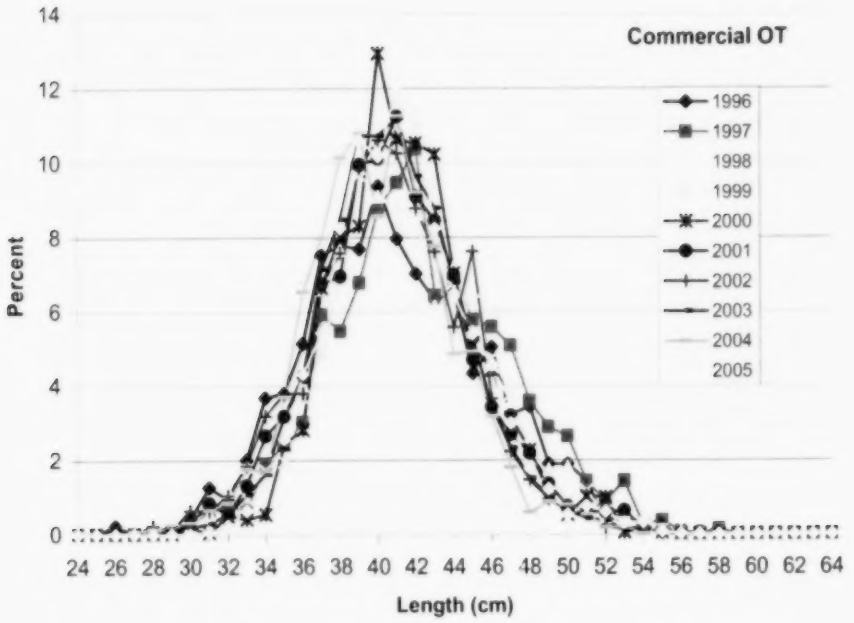

Fig. 4. Percent of witch flounder caught at length (cm) from the Canada (Newfoundland) commercial offshore otter trawl fishery in NAFO Subdivision 3Ps from 1996-2005.

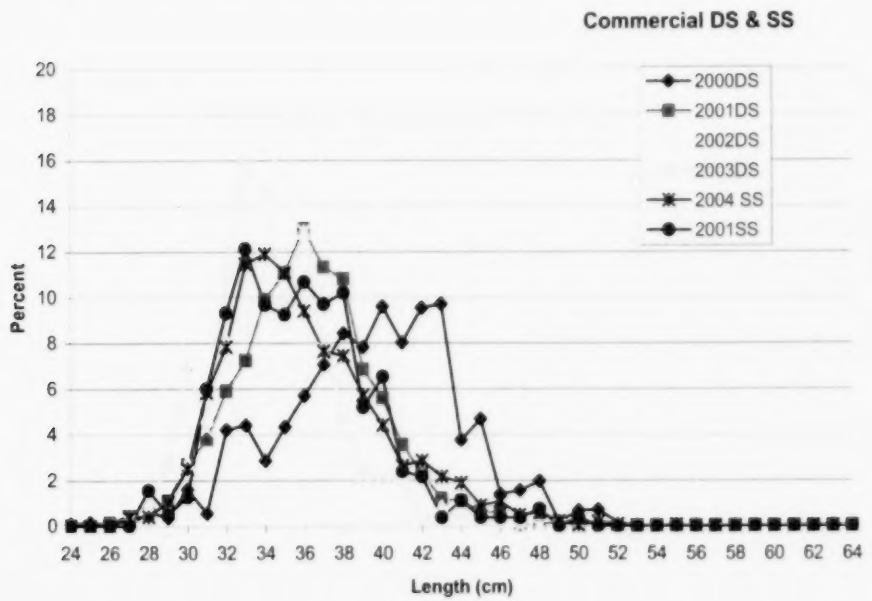

Fig. 5. Percent of witch flounder caught at length (cm) from the Canada (Newfoundland) commercial Danish Seine and Scottish Seine fishery in NAFO Subdivision 3Ps from 1996-2005.

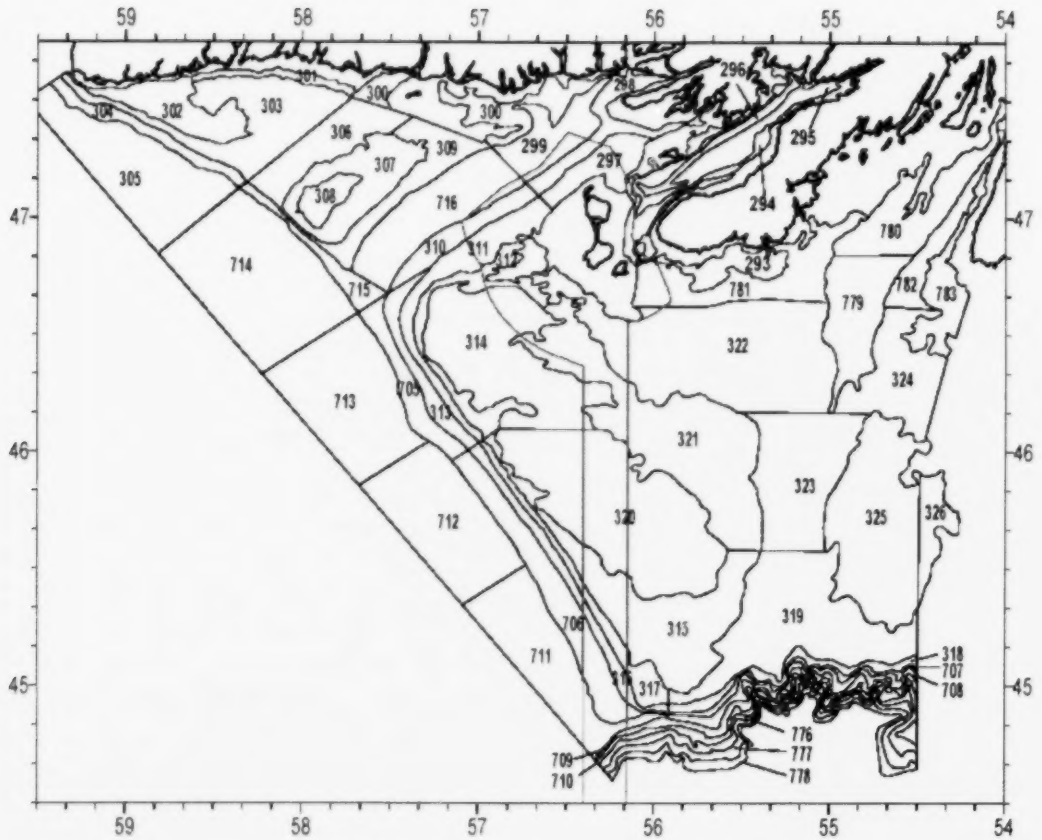

Fig. 6. The survey area in NAFO Subdivision 3Ps showing strata boundaries currently used in the spring research vessel bottom trawl surveys.

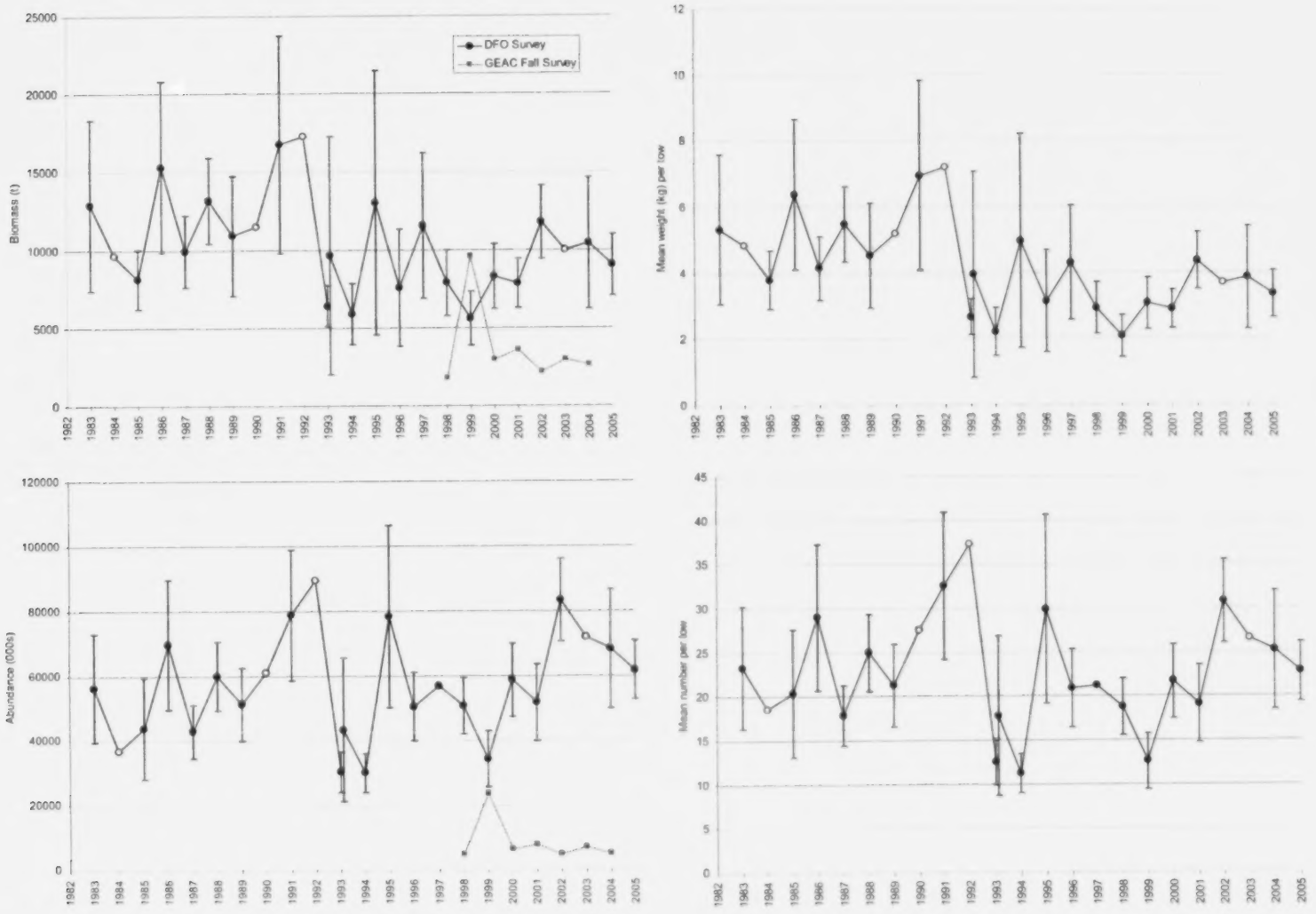

Fig. 7. Biomass (tons), abundance (000s), mean weights (kg) per tow and mean numbers per tow of witch flounder in Subdivision 3Ps from 1983 to 2005 and GEAC surveys from 1998 to 2004. Where 95% confidence limits were negative, they were omitted (hollow symbols).

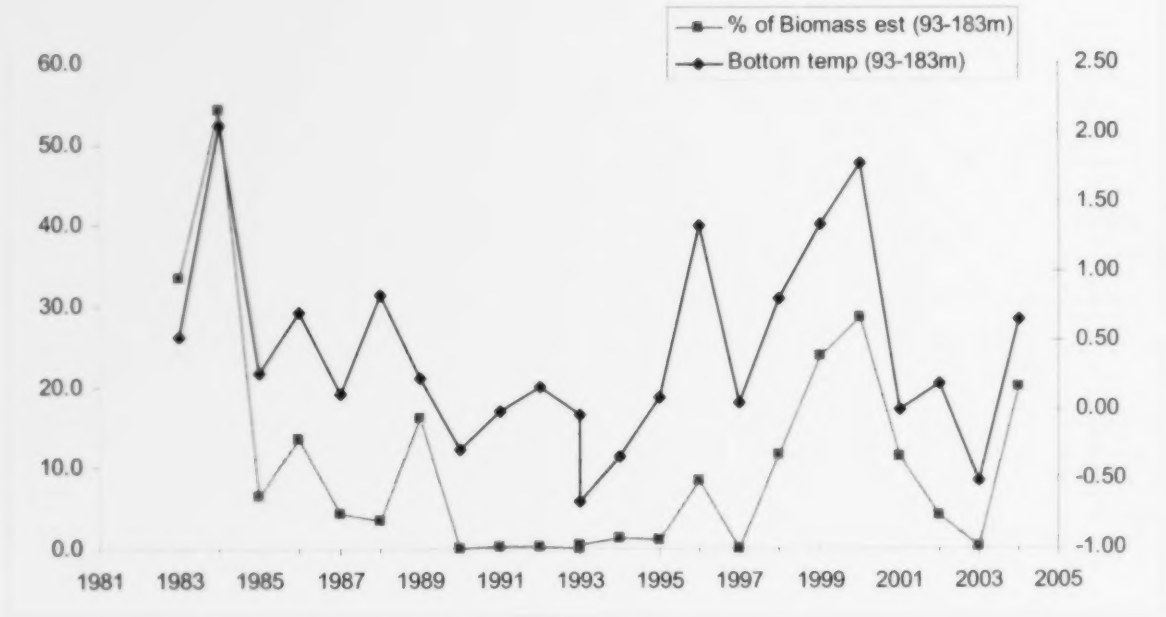

Fig.8. Percentage of biomass estimate found in the 93-183m depth zone and bottom temperatures from the vessel surveys 1983-2004.

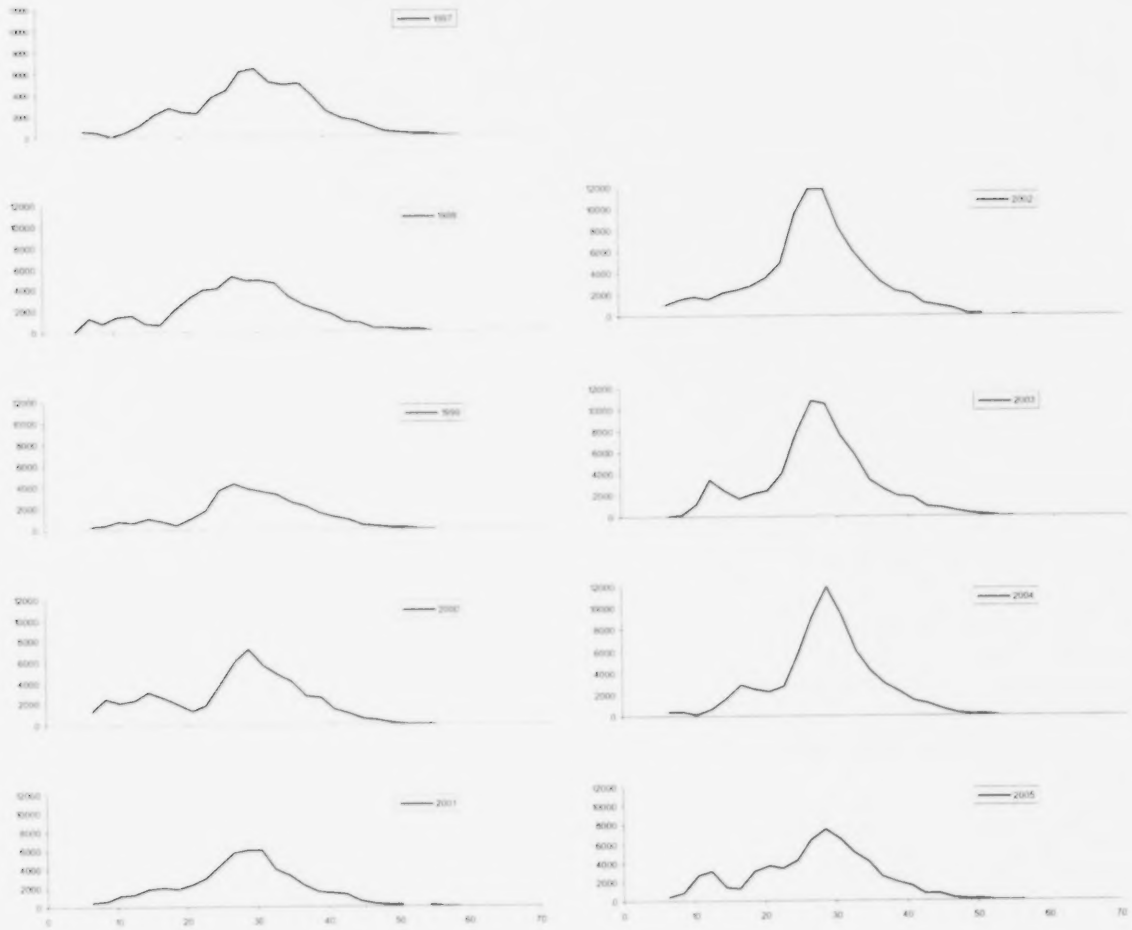

Fig. 9. Abundance (000s) at length (cm) of witch flounder from Canadian spring surveys in NAFO Subdivision 3Ps during 1997 to 2005.

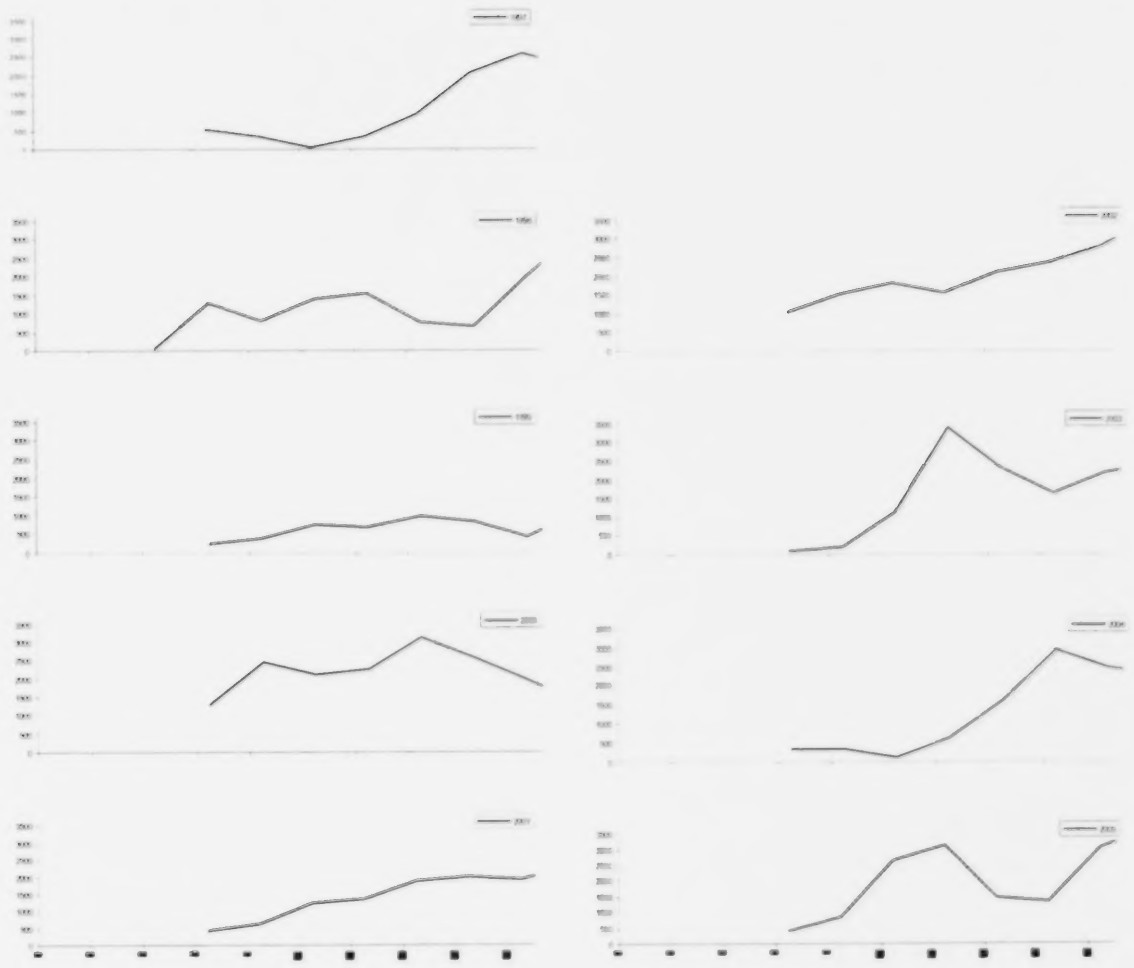

Fig. 10. Abundance (000s) at length (cm) of witch flounder (less than 20 cm) from Canadian spring surveys in NAFO Subdivision 3Ps during 1997 to 2005.

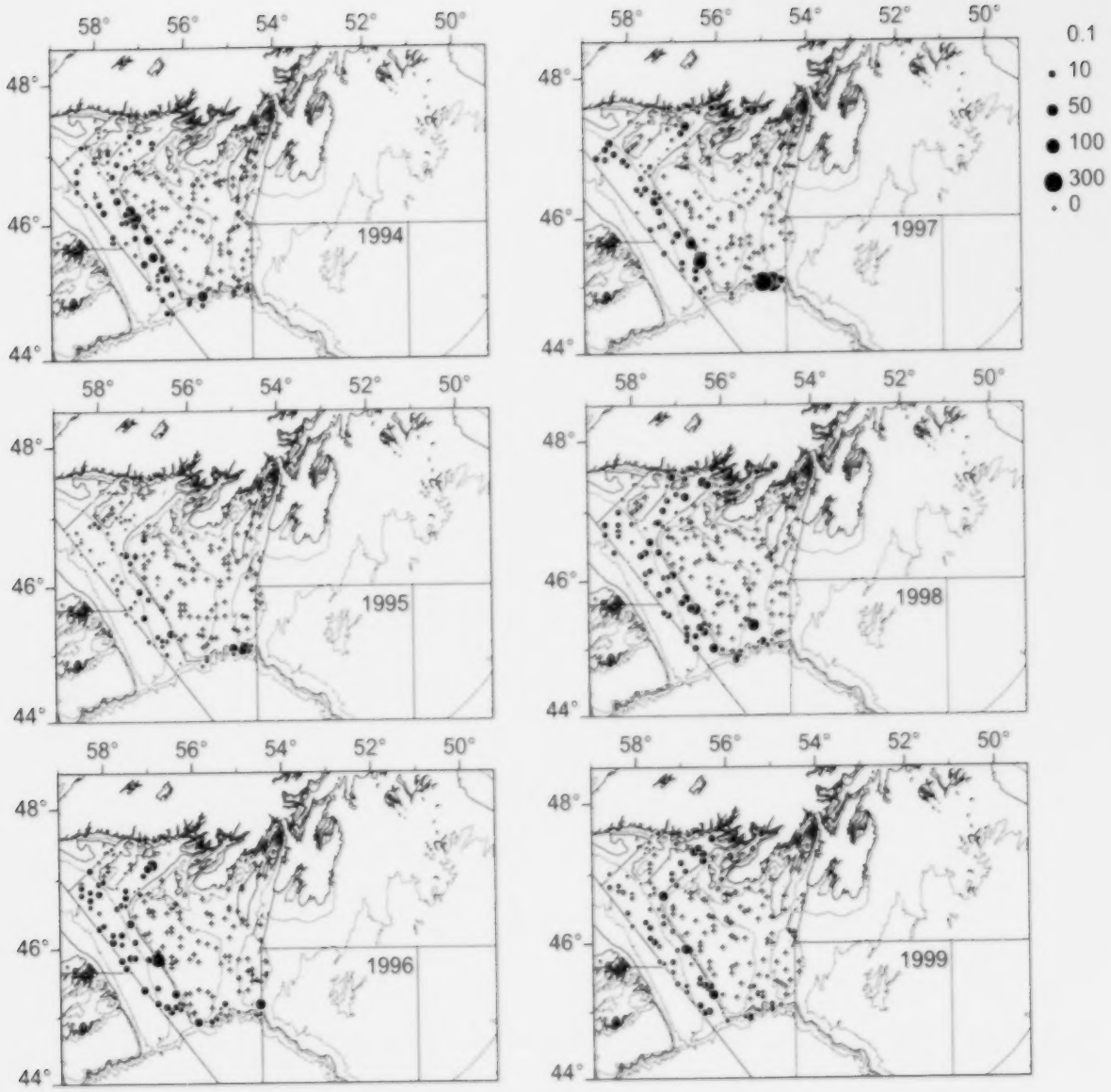

Fig. 11. Witch flounder distribution (kg/set) from Canadian spring surveys conducted using a Campelen shrimp trawl from 1994-1999.

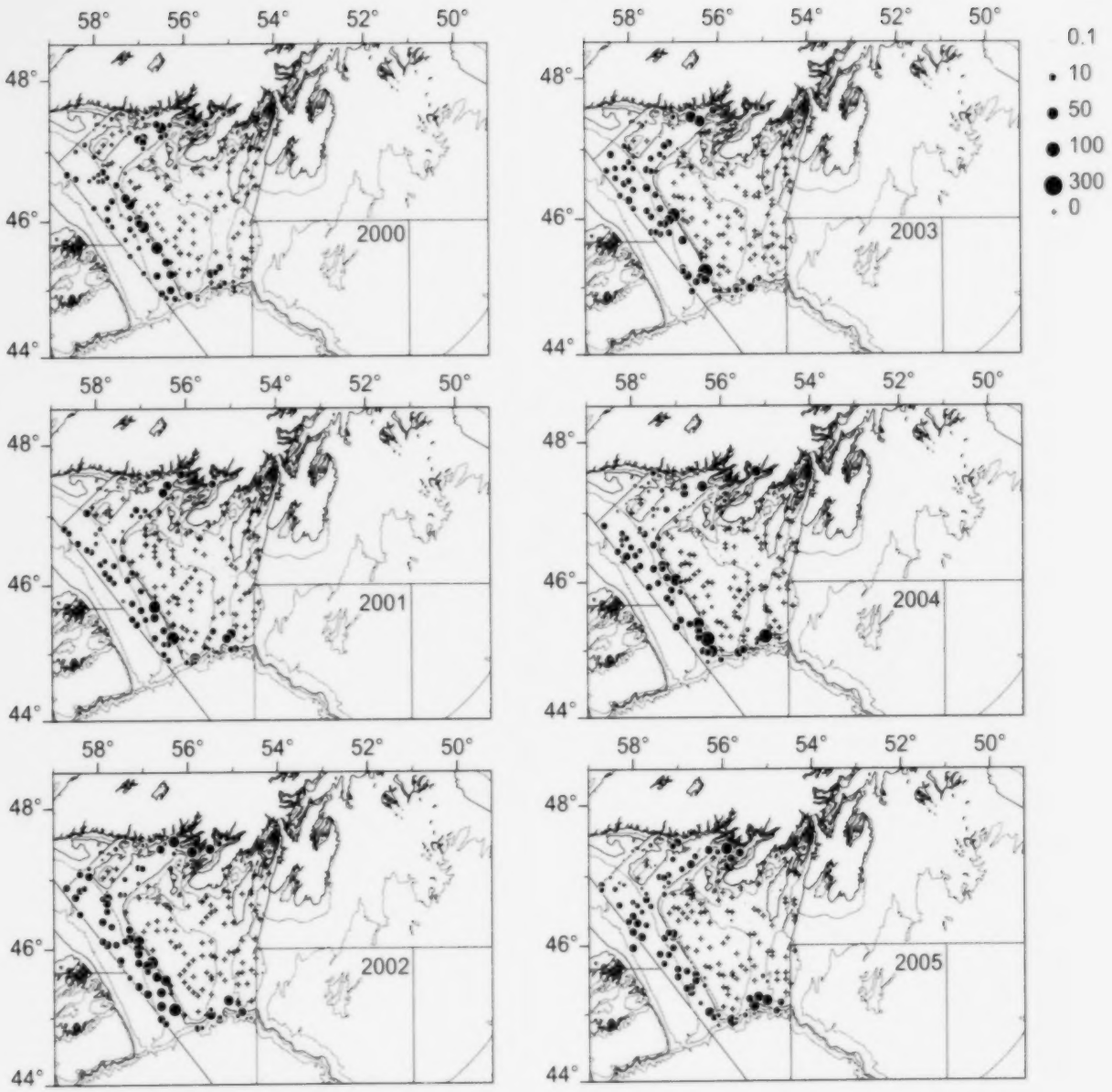

Fig. 12. Witch flounder distribution (kg/set) from Canadian spring surveys conducted using a Campelen shrimp trawl from 2000-2005.

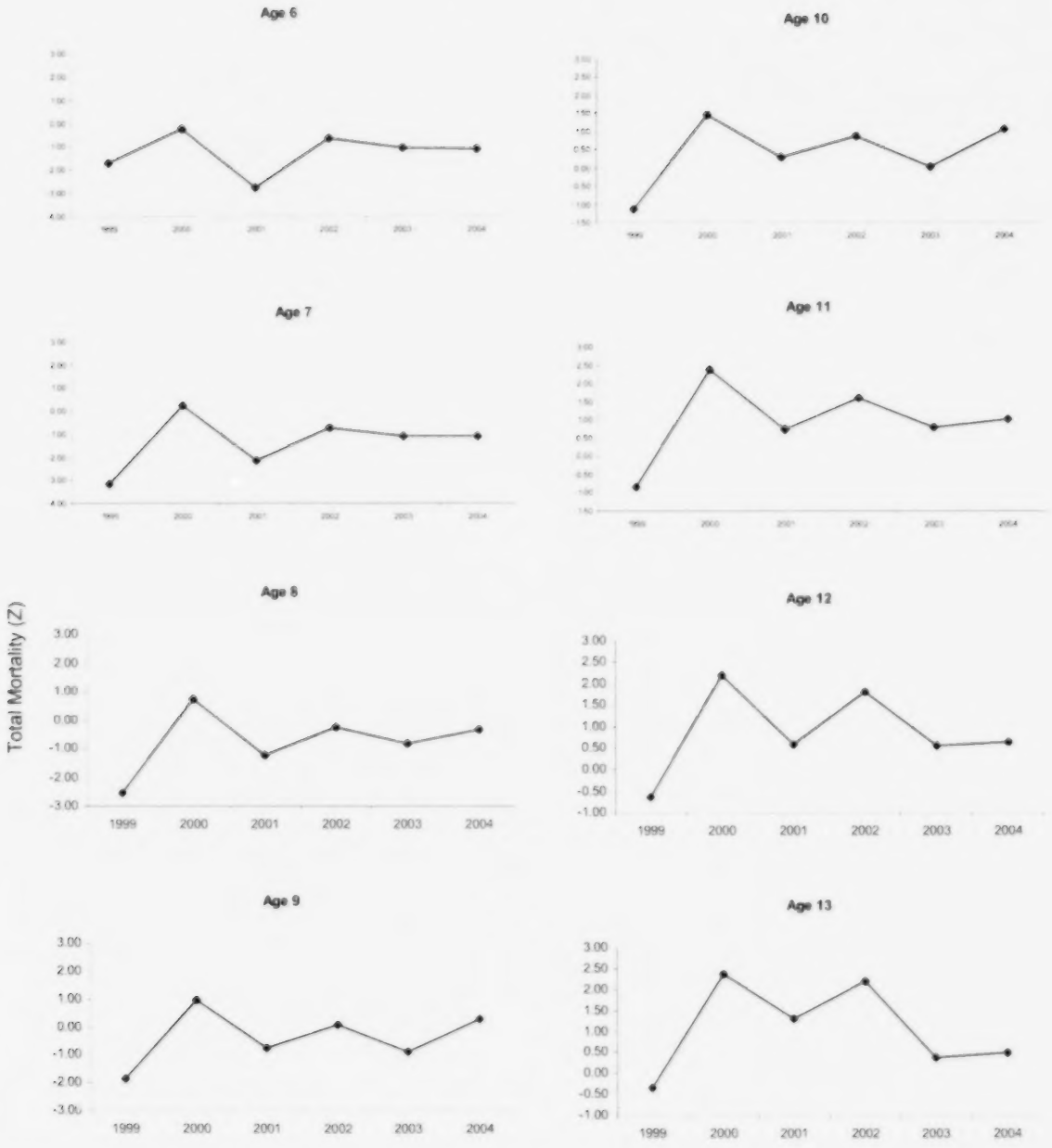

Fig. 13. Total mortality estimates (Z) for ages 6-13 from the GEAC fall surveys 1999-2003.

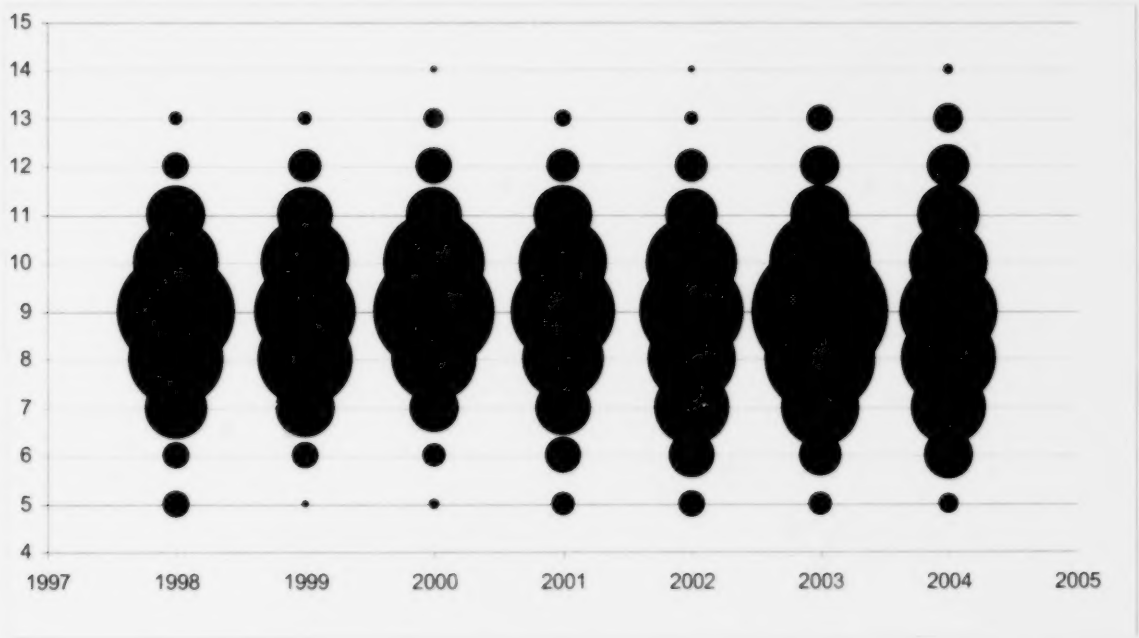

Fig. 14. Abundance at age (relative to the mean of each year) of witch flounder from the GEAC fall survey 1998-2004.